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Myopic Loss Aversion and the Equity Premium Puzzle:

"Can myopic loss aversion (MLA) be a possible solution to the equity premium puzzle and do the participants in the experiment exhibit MLA when investing for themselves as well as for others?"

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STUDIEPROGRAM: Master i Økonomi og Administrasjon	OPPGAVEN ER SKREVET INNEN FØLGENDE SPESIALISERINGSRETNING: Anvendt Finans ER OPPGAVEN KONFIDENSIELL? Nei (**NB**! Bruk rødt skjema ved konfidensiell oppgave)

TITTEL: Myopisk tapsaversjon og aksjepremiemysteriet: “Kan myopisk tapsaversjon være en mulig løsning på aksjepremiemysteriet og viser deltakerne i eksperimentet adferd konsistent med myopisk tapsaversjon både når de investerer for seg selv og for andre?

ENGELSK TITTEL: Myopic Loss Aversion and the Equity Premium Puzzle: *“Can myopic loss aversion (MLA) be a possible solution to the equity premium puzzle and do the participants in the experiment exhibit MLA when investing for themselves as well as for others?”*

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Abstract

Two concepts from behavioural economics, loss aversion and mental accounting, have been combined to give a theoretical explanation of the equity premium puzzle. Most of the recent experimental results support the theory, as the behaviour of both students as well as professionals has been found to be consistent with myopic loss aversion (MLA).

However, the main focus has been on investing for oneself and scarcely on investing on behalf of others. Many decisions, for example choices by fund managers affect not only their own potential performance pay but also clients returns. The outcome of these choices can again influence both future decisions by the fund manager and the amount that clients are willing to invest, and therefore influence the size of the equity premium.

To investigate this further I ran an experiment with the aim of testing prior findings of MLA in investing for oneself, and more importantly on testing whether behaviour on behalf of others is similar. In order to test this I combined both investing for oneself and others in the same experiment using a within-design, and as far as the author is aware of, this has never been done before. Results show no MLA findings in investments on behalf of others, suggesting that participants are not influenced by the frequency of feedback when investing for others.

Preface

This paper represents the final part of a two year master's degree program in Business Administration at the University of Stavanger (UiS). A master's thesis is a perfect occasion to work with something that attracts your interest. My attention was therefore headed towards the financial markets and one of its many unsolved puzzles. In particular I find a proposed solution to the Equity Premium Puzzle, namely Myopic Loss Aversion interesting – and thus wanted to investigate the issue further.

The main research question is as follows:

Can myopic loss aversion (MLA) be a possible solution to the equity premium puzzle and do the participants in the experiment exhibit MLA when investing for themselves as well as for others?

I would like to use the opportunity to thank my thesis advisor Kristoffer Wigestrand Eriksen for great commitment and quality advising. I would also like to thank Stiftelsen for Anvendt Finans (SAFI) for providing financial support (20,000 NOK) to the experiment and thesis.

Thereafter, I would like to thank fellow student Ole Bergesen for assisting me on the day of the experiment. My friend and PhD candidate, William Gilje Gjedrem, also deserves an extra thank you for being available to answer questions regarding data analysis.

Finally, a huge thank to my family for contributing with other valuable inputs.

Stavanger, June 2013

Jon Kristian Heimdal

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1.0 Introduction

In this paper I will study whether myopic loss aversion (MLA) serves as a possible solution to the equity premium puzzle. The equity premium puzzle (EPP) is that in the long-term stocks have outperformed bonds by a big margin and that this margin is difficult to explain, and thus is a puzzle. One of the possible explanations to the puzzle is myopic loss aversion (MLA), a behavioural theory that combines the fear of losses and frequency of evaluating investments.

To investigate MLA as a possible solution to the EPP, I wanted to conduct an experiment with the aim of testing prior findings. In addition and more importantly, since there has been scarce research on how agents make choices on behalf of others, I added this element to the experiment design. The design is based on Gneezy and Potters experiment design from 1997. The participants shall decide how much they want to invest from 0 up to 100 in a lottery. In each round the participants will with 1/3 probability earn 2,5 times the invested amount and 2/3 times they will lose the amount invested. The amount that they decide not to invest is a certain gain. The participants were also divided into two main groups. One group received low frequency (LF) of feedback and the other received high frequency (HF) of feedback.

Gneezy and Potters' participants invested only for themselves in 9 rounds. In my experiment, however, participants will make choices in two different conditions; for themselves ("own") in six rounds and for "others" in six rounds. This change allows me to study differences in investment amounts between "own" and "others" as well as checking for MLA in both conditions. Finally, it allows me to do a robustness check of previous findings that men tend to invest more than women.

The combination of both investing for oneself and others in the same experiment, has as far as the author is aware of, never been done with the GP-design before. This change in the design is relevant to the EPP since most prior research has focused on how people invest on behalf of themselves and little on how they invest for others. In the real world you often face decision-making on behalf of others, either directly or indirectly. For example when one person in a couple invests, his or her decisions can influence the whole household economy. Another example is a fund manager or financial advisor where his or her decisions can influence both clients returns and his or her performance payment. Thus, if people exhibit MLA when investing on behalf of others, it can also influence the size of the equity premium.

Research on investment decisions made by individuals has found MLA a reliable source for explaining at least some of the premiums puzzle. Researchers have used students, financial advisors, teams and more recently adolescents in controlled experiments to test various hypotheses. A design first used in 1997 by Gneezy and Potters (GP) has often been used to test this. Except for Eriksen and Kvaløy (2010a), there have been no research with the GP-design on behalf of others. Chakravarty, Harrison, Haruvy, and Rutström (2011), however, investigated participants choices on behalf of themselves and others in the same experiment, using a first price sealed bid auction, and a lottery choice task known as multiple price list (MPL).

On 9th of April 2013 I ran an experiment with 79 undergraduate students from the University of Stavanger to investigate MLA as a possible solution to the EPP. The results from the analysis between the frequency groups, LF and HF, are statistically different using Mann-Whitney U-test when participants made choices for themselves ("own"), but not when deciding for "others". The difference in "own" is greater in the last three rounds, than the first three, which points towards MLA. Therefore prior findings of MLA in "own" seem robust. Results in "others" is, however, not consistent with MLA, and thus contrary to the only published paper on investing for "others" with GP-design (Eriksen & Kvaløy, 2010a). There is, however, a statistical difference in LF but not in HF when comparing "own" vs "others". Thus, people seem to take more risk when making choices for themselves compared to others, but this effect seems to be neutralized when you receive feedback more often. Men invested significantly more than women in both LF and HF and in total (LF+HF) according to Mann-Whitney U-test. However the results were not significant when controlling for other factors, such as previous participation.

The paper is divided into five main parts, first a theoretical part where I will go through relevant background theory, before going through the theory on equity premium puzzle and myopic loss aversion. In the second part I will go through relevant previous research and experiments. In the third part I will explain the experimental design and procedure. Then I move on to presenting the results from the experiment and my interpretation of the findings. In the end I draw conclusions and discuss the findings, before making some final reflections.

2.0 The theoretical part

In the theoretical part of the thesis I will give an introduction to decision theory, the expected utility theory (EUT) and prospect theory (PT). These theories give an understanding of how a person rates different possible choices against each other, for example different investment alternatives. Then I will account for how to value assets with the help of the capital asset pricing model (CAPM). An extension to the CAPM, the consumer capital prizing model (CCAPM), will also be mentioned. The CAPM is an important foundation for understanding the equity premium puzzle (EPP), which leads to the main part of the thesis; myopic loss aversion (MLA).

2.1 An introduction to decision theory

The domain of decision theory deals with choice under uncertainty. There are at least two different approaches to this theory; the prescriptive approach and the descriptive approach. The differences between them are the views on human behaviour. The prescriptive approach focuses on how individuals should act, and assumes a perfect decision-maker who has full information as well as being able to decide with perfect accuracy and full rationality. In contrast the descriptive approach tries to describe how individuals actually make decisions. The approach does so by including psychological aspects of individuals and assumes that individuals do not always act rationally (Montier, 2002).

Two approaches to decision theory is the expected utility theory and prospect theory. Daniel Bernoulli first initiated the expected utility theory in 1738, after founding the St. Petersburg Paradox in 1713. More than 200 years later the theory was accepted partly because of the axioms by John von Neumann and Oskar Morgenstern (1944). Eventually, during the 20th century, empirical studies made it clearer that individuals do not always behave rationally. The background for that was the documented violation of expected utility, known as the Allais Paradox and later also the Ellsberg Paradox, which will be explained later. Kahneman and Tversky later developed a behavioral economic theory named prospect theory (1979).

2.2 Expected utility theory

Expected utility theory is a normative behavioral model which tries to explain how you rationally should choose between alternatives when faced with uncertainty. The theory predicts that a person faced with a situation of choice, will evaluate options on the basis of two factors; the likelihood of the outcome and the expected utility of the outcome. A good way to illustrate decision-making under risk is by using prospects. You can then assign probability to choices and then again find the expected utility of the prospect. The application of expected utility theory of choices between prospects is based on three tenets according to Kahneman and Tversky (1979). These tenents are expectation, asset integration and risk aversion.

Expectation can be described as follows: $U(X_1, P_1; ... ; X_n, P_n) = P_1u(X_1) +... +P_nu(X_n)$. That means that the overall utility of a prospect, denoted by U, is the expected utility of its outcomes, meaning the weighted average of all values. Asset integration $(X_1, P_1; ... ; X_n, P_n)$ is acceptable at asset position w if $U(w+X_1,P_1;\ldots;w+X_n,P_n) > u(w)$. Thus, a prospect is acceptable if the utility resulting from integrating the prospect with one's assets exceeds those assets alone. Risk aversion states that an individual is risk averse if he or she prefers a certain prospect x to any prospect with an expected value of x. A risk averse individual would rather have 100 for certain, compared to a 50-50 bet between 200 and nothing. In EUT, risk aversion is equivalent to the concavity of the utility function, and is also among the best known generalizations concerning risky choices (Kahneman and Tversky 1979).

2.2.1 The four axioms of rationality

Von Neumann and Morgenstern (1944) present four axioms that define the individual's preferences in lotteries or prospects, and the expected utility theory is dependent on these. They are known as the axioms of rationality, and they make assumptions on completeness, continuousness, transitivity and independence.

Completeness states that, if you have the option of A or B, you will rationally choose between them depending on your preferences. Thus you will either choose A over B, B over A, or be indifferent to the options. Transitivity is related to the consistency of the preferences, saying that if you prefer A over B, and B over C, you will prefer A over C as well. Continuousness assumes the relationship that, if an individual prefers A over B and B over C, then there will be a chance, here noted as p, that B is as good as pA+(1-p)C. Therefore a small change in the composition could cause changes in the ranking. Lastly, the independence axiom says that you can mix two lotteries with a third lottery, without changing the preference order between the first two lotteries.

If an individual is rational all the axioms above should be satisfied and the preferences can be represented by a utility function. Thus if an individual always chooses his or her most preferred alternative, then he or she will choose one gamble over another if and only if the expected utility of the gamble exceeds the other gamble and therefore maximizes his or her utility.

2.2.2 Risk attitude and risk aversion

Expected utility theory is set up to deal with risk and not uncertainty. A risky situation is one in which you know what the outcomes may be and can assign a probability to each outcome. Uncertainty is when you cannot assign probabilities or come up with a list of possible outcomes.

According to Ackert & Deaves (2010) it is for most purposes, when considering decision-making under risk, sufficient to think only in terms of wealth. To illustrate this I can give the following example, where we for simplicity think of a world with two only two possible outcomes; low wealth and high wealth. If the wealth is low it is 50,000 USD and wealth is high if it is 500,000 USD. Then we further assume that we can assign a probability for each outcome, say 50% chance for high wealth and 50% chance for low wealth. We then use the notation U(P) for the expected utility of the prospect, and u is the utility for each of the outcomes:

$$U(P) = 0{,}50u(50{,}000) + 0{,}50u(500{,}000)$$

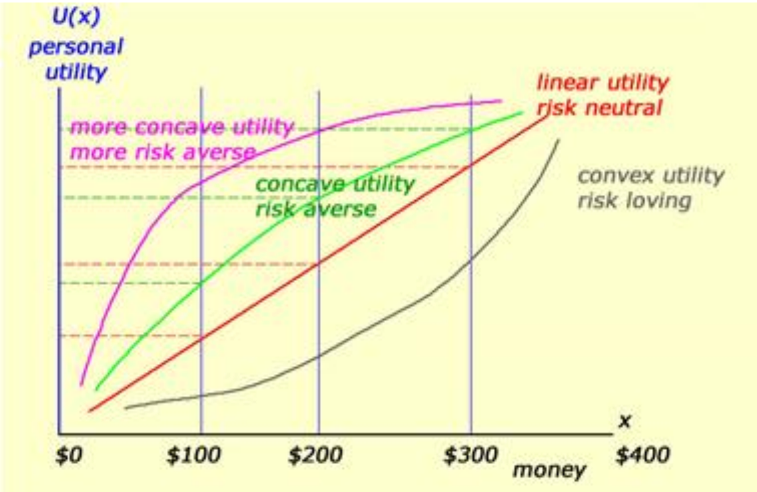
It is common to assume that people have diminishing marginal utility of wealth. A logarithmic utility function is therefore often used when calculating the expected utility of this prospect. Results using a logarithmic function are as follows:

$$U(P) = 0{,}50(1{,}609) + 0{,}50(3{,}912) = 2{,}76$$

This utility function can be useful when illustrating risk preferences. The expected value of wealth is 50,000*0,50+500,000*0,50=275,000, and the logarithmic utility from the expected value is 3,31. A person with a logarithmic utility function therefore prefers the expected value of the prospect compared to the prospect itself, since 3,31 > 2,76 and thus u(E(W)) > U(P). This person would then rather have 275,000 USD in cash for certain instead of entering a lottery with a 50% chance of getting 50,000 USD and 50% chance of getting 500,000 USD. A person with these characteristics dislikes risk and is risk averse.

A person that likes to take risks is called a risk seeker with preferences satisfying u(E(W)) < U(P), whereas a person that only cares about expected values and does not care about risks is called risk neutral, with preferences u(E(W)) = U(P). In the above example a risk seeker would gamble between getting 50,000 or 500,000 with equal probability, rather than getting 275,000 for certain, while a risk neutral would be indifferent between the certain 275,000 and the 50-50 gamble between 50,000 or 500,000. Risk preferences are illustrated in figure 1.

Figure 1 A Utility Function



If a person is risk neutral with this utility function U(x) equals x, risk loving if preferences satisfying x < U(x), and risk averse if preferences satisfy x > U(x).

*Collected from University of Canterbury:
http://www.econ.canterbury.ac.nz/personal_pages/john_fountain/econ223/week8/lect152010v1classhandout.html

2.2.3 Critics and violations of expected utility theory

The main difference between expected utility theory and prospect theory is that whereas expected utility theory is about how the world should be, prospect theory focuses on how the world actually is. (Montier, 2002).

Critics gradually began to rise against expected utility theory and thus prospect theory was eventually founded. The economist Maurice Allais was the first to recognize that expected utility theory is not descriptive of how individuals actually make choices. One violation of expected utility theory is known as the Allais Paradox.

2.2.4 The Allais paradox

The Allais paradox arises when comparing choices made by participants in two different experiments, each of which consists of a choice between two gambles, A and B. A well-known example is as follows (Conlisk, 1989):

Question 1:

Gamble 1A 100% chance of winning 1 million
Gamble 1B 89% chance of winning 1 million, 10% chance of winning 5 million and 1% chance of getting nothing.

Question 2:

Gamble 2A: 89% chance of winning nothing and 11% chance of winning 1 million
Gamble 2B: 90% chance of winning nothing and 10% chance of winning 5 million

The study by John Conlisk found that when presented with a choice between 1A and 1B, most people would choose 1A. Likewise, when presented with a choice between 2A and 2B, most people would choose 2B. It is fair to choose 1A alone or 2B alone but if the same individual would choose both 1A and 2B together it is inconsistent with expected utility theory. According to expected utility theory, this individual should choose either 1A and 2A or 1B and 2B. Why is it so?

The inconsistency comes from the fact that in expected utility theory, equal outcomes added to each of the two choices should have no effect on the relative desirability of one gamble over another. Each question gives the same outcome 89% of the time. Hence, if this 89% similarity is disregarded, then we are left with the same options.

Thus, we can re-write the payoffs. After disregarding the 89% chance of winning the same outcome 1B is left offering a 1% chance of winning nothing and a 10% chance of winning $5 million. 2B is left offering a 1% chance of winning nothing and a 10% chance of winning $5 million. Therefore, 1B and 2B can be seen as the same choice. Thus, in the same way, 1A and 2A should also be seen as same options.

2.2.5 The Ellsberg paradox

Another violation of EUT is the Ellsberg paradox (Ellsberg, 1961) which can be described with an example as follows:

A box contains 30 red balls and 60 black and yellow balls, where the exact number of yellow and black balls respectively is unknown. You will draw a random ball from this box:

Question 1. Do you prefer to put your money on a red ball (A) or a black ball (B)?
Question 2. Do you prefer to put your money on a red and yellow ball (C), or a black and yellow ball (D)?

Since the alternatives are exactly the same, it follows that you will prefer A to B if and only if you believe that drawing a red ball is more likely than drawing a black ball. Also, there should be no clear preference between the choices if you thought that a red ball was as likely as a black ball. At the same time it states that you will prefer C to D, if and only if, you believe that drawing a red or yellow ball is more likely than drawing a black or yellow ball. It might seem intuitive that, if drawing a red ball is more likely than drawing a black ball, then drawing a red or yellow ball is also more likely than drawing a black or yellow ball. So, if you prefer A to B, it states that you will also prefer C to D, and if you prefer B to A, it states that you will also prefer D to C. Since research has shown that most people prefer A over B, as well as D over C this violates expected utility theory.

Thus, a number of violations of expected utility theory, have been identified and this has led to the rise of alternative theories, with the most well-known being prospect theory.

2.3 Prospect theory

Prospect theory was presented as an alternative to expected utility theory by the psychologists Daniel Kahneman and Amos Tversky (1979). Kahneman later received the Nobel Memorial Prize in Economics in 2002; *for having integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty*. Kahneman and Tversky (1979) showed that individuals did not act according to expected utility on many occasions, for example when they asked these questions to a group of people:

Choose between:
A. 25% chance to win $240 and 75% chance to lose $760 (0%)
B. 25% chance to win $250 and 75% chance to lose $750 (100%)

In this question all participants chose B over A as according to EUT. In the next question however:

Decision (1) Choose between:
A. A sure gain of $240 (84%)
B. 25% chance to gain $1,000 and 75% chance to gain nothing (16%)

Decision (2) Choose between:
C. A sure loss of $750 (13%)
D. 75% chance to lose $1,000 and 25% chance to lose nothing (87%)

In the second question a large majority of subjects made a risk averse choice for the sure gain (A) over the positive gamble (B) in the first decision, and an even larger majority of subjects made a risk seeking choice of gamble (D) over the sure loss (C) in the second decision. Actually 73% of the respondents chose A and D and only 3% chose B and C. This behaviour is not consistent with the EUT.

In this case EUT cannot give an explanation of why individuals choose different alternatives on identical questions. EUT tells that an individual should not be affected on how choices are framed and presented. Problem 3 and 4 above shows just the opposite, and that the way choices are presented has a direct effect on the outcome of answers made by individuals.

With the help of empirical studies Kahneman and Tversky found three key aspects of behaviour patterns that proved contrary to EUT. First individuals can be both risk seeking and risk averse depending on how choices are presented. For example individuals can be risk seeking when it comes to losses and risk averse when it comes to gains. Second individuals will value different options or choices when it comes to changes in wealth, from a given reference point. This reference point is usually the status quo, thus the current situation. The third key observation is that individuals in general are loss averse meaning that losses loom larger than gains. From this Kahneman and Tversky provided a model of decision-making under risk that incorporates observed behaviour.

2.3.1 The value function

The value function in prospect theory replaces the utility function in the EUT. Instead of using simple probabilities, prospect theory uses decision weights. (Ackert & Deaves, 2010). The decision weights are a function of probabilities. Ackert and Deaves (2010) use v(z) to refer to the value of a change in wealth, where z refers to a wealth level. The value of the prospects is noted as V(P), and for a prospect P(pi, z1, z2) the value is:

$$V(p_i,z_1,z_2) = V(P) = ɲ(pi) * v(z_1) + ɲ(1\text{-}p_i) * v(z_2)$$

where ɲ is the decision weight associated with probability p_i. V(P) the value of the prospect is the same as U(P) the expected utility of the prospect.

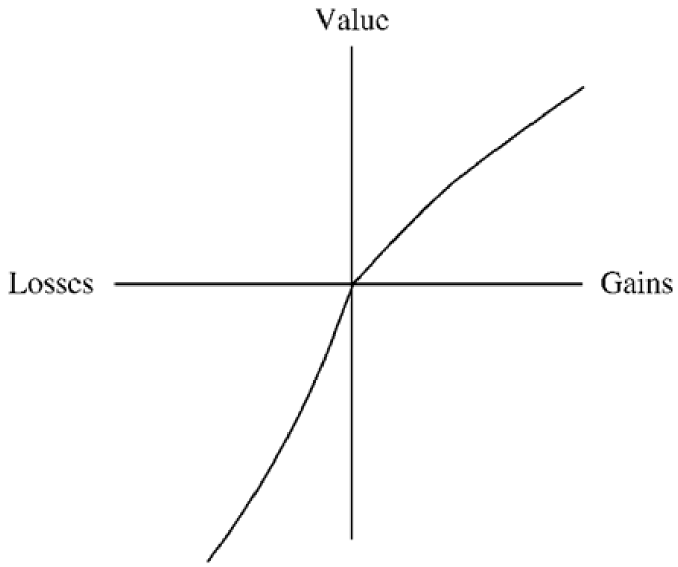
As mentioned by Thaler (1999) mental accounting can be described as; *a set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities*. The value function has three important features, all of which captures an important element of mental accounting.

First, the value function is defined over gains and losses relative to some reference point. The focus on changes, rather than wealth levels, as in the EUT, reflects mental accounting in practice. For example a single transaction is often evaluated by itself, rather than together with all other transactions.

Second, the gain and loss functions display diminishing marginal sensitivity. Thus, the gain function is concave and the loss function is convex. This feature reflects that the difference between 5 and 10 dollars seem bigger than the difference between 505 and 510 dollars.

Third, it shows that individuals suffer from loss aversion, meaning that losing 100 dollars hurts more than gaining 100 dollars yields in pleasure.

Figure 2 A typical value function



Here you can see how choices are valuated from a given reference point (origo).

*Collected from Kahneman and Tversky (1979)

In this model a change in wealth from a reference point determine the value along the vertical axis, and not the terminal wealth. The value function is concave in the positive domain and convex in the negative domain. This indicates risk aversion in the positive domain and risk seeking in the negative domain, where it is also steeper in the negative domain, thus losses loom larger than gains. In general this indicates that people are loss averse since losses are felt more strongly than gains of the same size.

For investors Kahneman and Tversky propose the following value function:

$U(x) = x^{\alpha}$ if $X \geq 0$

$U(x) = -\lambda(-x)^{\beta}$ if $X \leq 0$

The parameter X shows the difference in wealth compared to the last time wealth was evaluated, and λ is a measure of loss aversion. Kahneman and Tversky have estimated α and β to be 0,88 and λ to be 2,25. An individual that is described by cumulative prospect theory is then only mildly risk averse for gambles that involve only gains. However he or she is strongly risk averse for gambles that can result in potential losses. Thus, the more often the investor evaluates his or her portfolio with this value function, the more likely it is to have a significant effect on investment decisions. Therefore the more frequently the investor evaluates his or her investments, the more likely he or she is to experience periods where the risky investments will have a lower return than the safer portion of his or her portfolio. Risky investments are often referred to as stocks, and safer investments as bonds. If losses loom larger than gains, i.e. $\lambda > 1$, the investor would reduce the portion of risky assets the more often he or she evaluates the portfolio.

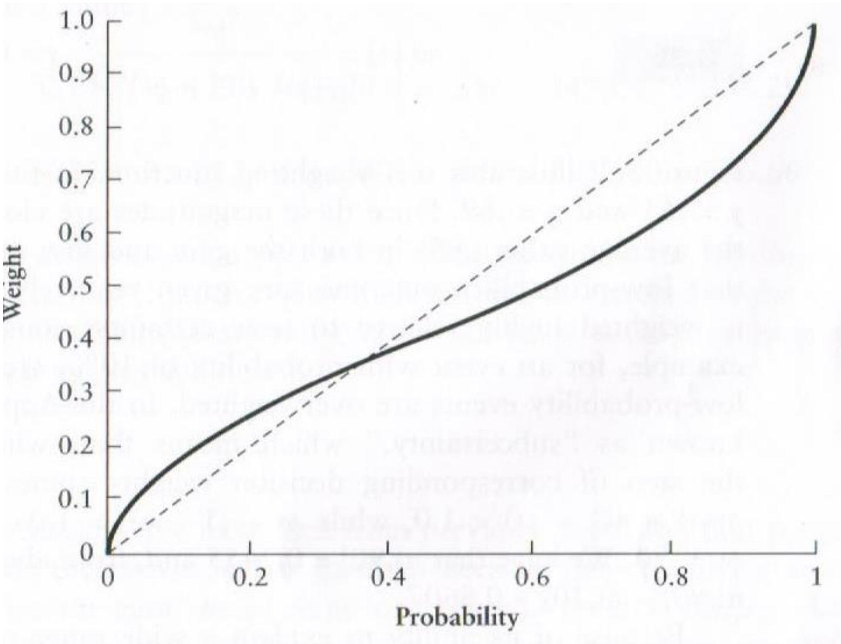
2.3.2 The weighting function

The weighting function in PT takes into account that people buy lottery tickets, where the expected payoff is less and often substantially less than the prize you paid. This symbolizes that people are being risk-seekers. The function also includes the observation that people buy insurance to reduce risk, even though the expected payoff is likely to be less than what you paid. This indicates a risk-averse behaviour. Prospect theory therefore incorporates overweighting of low-probability events by using decision weights ($ɲ(p_i)$), rather than event probabilities (p_i) to determine the value of prospects (Ackert & Deaves, 2010).

Kahneman and Tversky found a fourfold pattern of risk attitudes (1992). This pattern suggests risk aversion for gains and risk seeking for losses when the probability of the outcome is high, as well as risk seeking for gains and risk aversion for losses when the probability of the outcome is low. Their paper along with the Allais Paradox show that individuals tend to overweight certain outcomes compared to outcomes that are likely.

This leads to the typical weighting function, where low probability and certain outcomes are overweighting compared to likely ones. Kahneman and Tversky describe this phenomenon as the certainty effect.

Figure 3 The Weighting Function



This is a typical picture of how individuals' weight options, where low probability events are over-weighted, medium and high-probability events under-weighted and certain events equal-weighted.

*Collected from Ackert and Deaves (2010, page 43)

Prospect theory has been used a lot in economic research and has been especially useful when it comes to behavioural finance. Behavioural finance combines both ideas from psychological and traditional economic theory to describe an individual's behaviour. Models from behavioural finance with the introduction of a descriptive model for human behaviour have increased our understanding of individual decision-making. These models have also given us a framework to investigate the many puzzles which has been observed in financial research, for example the equity premium puzzle (EPP), which will be explained after the capital asset pricing model (CAPM) and the consumer capital asset model (CCAPM).

2.4 The capital asset pricing model (CAPM)

Assets that pay off when times are good and consumption levels are high - that is, when the incremental value of additional consumption is low - are less desirable than those that pay off an equivalent amount when times are bad and additional consumption is more desirable and more highly valued. (Mehra & Prescott, 1985).

This can be illustrated with the well-known theoretical model for stock pricing, the capital asset model. To derive the CAPM we need two assumptions (Bodie, Merton, & Cleeton, 2009). First, the investors agree in their forecasts of expected rates of return, standard deviations, and correlations of the risky securities, and they therefore optimally hold risky assets in the same relative proportions. Second, the investors generally behave optimally. In equilibrium, the prices of securities adjust so that when investors are holding their optimal portfolios, the aggregate demand for each security is equal to its supply.

Thus, the capital asset pricing model shows the relationship between a stocks beta (β) which is a measure of systematic risk and the expected return. The expected rate of return for a stock can then be presented as follows (Hveem, Mjølhus, Norstoga, & Plahte, 2010):

$$E(R) = rf + \beta(E(Rm) - rf)$$

Where rf is the risk free rate (a rate of return of an investment with no risk of financial loss), β a measure of the stocks sensitivity to the market in general and E(Rm) the expected rate of return in the market, i.e. the sum of the risk free rate and the risk premium. Therefore a stock with a high beta will have a higher expected rate of return than the market in general. Likewise a stock with a low beta will have a lower expected rate of return than the market in general.

2.5 The consumer capital asset pricing model (CCAPM)

The CCAPM is a financial model that extends the capital asset pricing model (CAPM) to include the amount that an individual or firm seeks to consume in the future. The CCAPM therefore uses consumption measures, which includes a consumption beta, in its calculation of a given investment's expected return. This beta for consumption tries to measure the covariance between an investor's ability to consume goods and services from investments, and the return from a market index. The CCAPM is in practice used more seldom than the CAPM and it is often advised that the model should only be used on a theoretical basis. In particular, many consumers do not actively take part in the stock market and thus the link between consumption and stock returns assumed by the CCAPM cannot hold.

The model builds on the idea that an investor prefers investments that gives more dividends or has a value increase when consumption falls. Such an investment will give the investor the possibility to maintain his or her consumption level because he or she receives dividends or could sell of a part of the investment at a satisfying price. In periods where the consumption level is high it is not important whether the investment pays out dividends or increase in value. Therefore investments that are positively correlated with consumption are less attractive compared to investments that are negatively correlated with consumption. Mehra and Prescott describes it as follows in the paper The Equity Premium Puzzle in Retrospect (2003):

Another perspective on asset pricing emphasizes that economic agents prefer to smooth patterns of consumption over time. Assets that pay off a larger amount at times when consumption is already high "destabilize" these patterns of consumption, whereas assets that pay off when consumption levels are low "smooth" out consumption. Naturally, the latter are more valuable and thus require a lower rate of return to induce investors to hold these assets.

There are different methods that can be used to estimate the equity premium. The most common is to estimate the difference between the return on a stock market index and a 10-year bond. Based on historical returns it is a common assumption that the equity premium will be around 5% in the future (Ackert & Deaves, 2010). How can this be explained?

2.6 Equity premium puzzle (EPP)

As followed from CAPM, the equity premium can be defined as the gap between the expected return on the aggregate stock market and a portfolio of fixed-income securities. The equity premium puzzle is that, in the long-term, stocks have outperformed bonds by a big margin, and that this high premium is difficult to explain. According to Mehra and Prescott (1985) this premium was around 6% between 1889 to 1978. One could also say that the EPP is the lack of an explanation that people still invest in government bonds, even though higher returns historically has been achieved by stocks.

Mehra and Prescott find that the difference in the covariance of returns between stocks and bonds with the growth of consumption, is only large enough to explain the difference in the average returns if the investor is implausibly averse to risk. They therefore claim that such a large premium is a puzzle since it according to conventional economic models would imply a coefficient of risk-aversion in excess of 30. This coefficient implies that a person would be indifferent between $51,209 for certain and a 50-50 bet between $50,000 and $100,000

(Mankiw & Zeldes, 1991). This doesn't seem realistic and Siegel and Thaler (1997) call it absurd.

According to Phillipe Weil (1989), you might as well call the puzzle the risk free rate puzzle, since the risk free rate has been so low. Weil shows, using the same data as Mehra and Prescott (1985) that a second anomaly is present. This is based on the following argument; even though individuals like consumption to be smooth over time, and although the risk-free rate has been very low, individuals still save enough so that the per capita consumption grows rapidly. This phenomenon is referred to as the risk-free rate puzzle.

According to *Credit Suisse Global Investment Returns Yearbook 2012*, the equity premium has been 3,5% relative to bonds between 1900-2011, and only 0,4% between 1962-2011, negative 1,9% between 1987-2011 and negative 4,5% between 2000 and 2011 in a globally diversified portfolio. Some therefore argue that there is no equity premium puzzle at all since there has not been a positive premium in the later years.

Other explanations that have been suggested are that the time period analysed by Mehra and Prescott isn't long enough to confirm the puzzle. Another mentioned explanation is "survivorship bias" by Reitz (1988). He argues that investors might be rationally worried about a small chance of an economic disaster of some kind that might have happened even though it hasn't yet. Myopic loss aversion (MLA) is another possible explanation, and by far the most relevant for my thesis and experiment. For extensions to explanations and other possible solutions to the equity premium puzzle, see *Anomalies: The Equity Premium Puzzle* by Siegel and Thaler (1997).

2.7 Myopic loss aversion (MLA)

The equity premium puzzle just discussed was put forward by Mehra and Prescott (1985). They refer to the enormous discrepancy between return on stocks and fixed income securities, and thus the unreasonably high levels of risk aversion that is needed to explain why investors are willing to hold bonds, and not allocate all their money in stocks. Several potential explanations and solutions for the equity premium puzzle have been proposed, with one of the most prominent being the theory of myopic loss aversion.

Myopic loss aversion was developed by Benartzi and Thaler (1995) and is based on two concepts from the psychology of decision-making, namely loss aversion and mental accounting. Loss aversion refers to the tendency that individuals seem to be more sensitive to losses than gains. Loss aversion also plays a central role in decision-making under uncertainty in prospect theory as presented earlier (Kahneman & Tversky, 1979).

The second behavioural concept Benartzi and Thaler (1995) present is mental accounting, which in the MLA-context refers to the implicit methods individuals use to code and evaluate financial outcomes. Both these concepts are illustrated in an example first presented by Samuelson (1963):

Samuelson offered a colleague a fifty-fifty bet of winning \$200 or losing \$100, an offer which he refused. The colleague however said he was willing to accept 100 such bets. This provoked Samuelson into proving a theorem to show that his colleague was irrational. A simple utility function, where x represents a change in wealth relative to status quo that would prove this was presented as follows:

$U(x) = x$ if $x \geq 0$ and $2{,}5x$ if $x<0$.

With this utility function the expected value of a single bet will be negative but positive with two or more bets;

One bet; -(2,5*100)*0,5+200*0,5= negative 25

The attractiveness of two bets depends on the mental accounting rules being used. If each play of the bet is treated as a separate event, then two plays of the gamble are twice as bad as one play. However, if the bets are combined into a portfolio, then the two bets will yield a positive expected utility with the above utility function, and as the number of repetitions increases the portfolio becomes even more attractive.

Two bets; -(2,5*200)*0,25+100*0,5+400*0,25 = positive 25

Mental accounting is illustrated in this utility function by the fact that the colleague would turn down one bet, but accept two or more bets as long as he didn`t have to watch the bet being played out. Loss aversion is also illustrated by the notion that the colleague would be more willing to take a risk if he didn’t evaluate the performance frequently, thus evaluating the bets as a portfolio of two bets, rather than independent single bets.

It is fair to draw a parallel with the above example to an investor that is going to invest in stocks and fixed income securities. If the investor is loss-averse, the evaluation period will be an influential factor for the investor’s attitude towards risk. The risky asset(s) will seem more attractive the longer periods he tends to hold it, as long as the investment is not evaluated frequently. Relatively risk-free assets, such as bonds, do not display losses as often as more risky assets and is therefore not as likely to be affected by MLA in same extent.

Based on the above discussion, MLA has shown to influence investment results and decisions. Investors that check the value of their portfolio with great frequency are more likely to be subject to MLA. Most investors now have the possibility to check their portfolio's valuation on a daily basis, i.e. they can expose themselves to the pain of losses. This pain can easily cause them to deviate from a thoroughly thought investment plan. This might especially happen in bear markets when the frequency and intensity of the pain is high. Investors can then become liable to a condition known as convex investing, which indicate behaviour of buying when prices are high and selling when prices are low.

Benartzi and Thaler (1995) argue that organizations such as pension funds could also be subject to MLA. The reason behind this is that pension funds are likely to exist as long as the company exists and thus the percentage amount placed in stocks should be high because of the long-term perspective and the historical risk premium. The fund manager is however not likely to be in his or her position forever, and regular reporting of results could create a conflict of interest because of this short horizon perspective.

One known example that could be directly related to MLA is the change that Bank Hapoalim in Israel made in February 1999. The bank decided to send fund reports only quarterly and not monthly liked they used to. The customers could of course check their investments daily but if they didn’t log on to their account and check their investments they wouldn`t get feedback as frequently as before. The banks expectations were that the investors would hold their investments for longer periods. Their argument was as follows; *investors should not be scared by the occasional drop in prices*.

There have been plenty of research and experiments with the aim of finding evidence for MLA and my experiment has the aim of testing these prior findings. In the next part of the thesis I will look at relevant prior research and prior experiments to the one I am going to conduct.

3.0 Relevant prior research and experiments

3.1 Experimental economics

Experimental economics is the application of experimental methods for studying economic questions, while an experiment is a procedure with the aim of verifying, falsifying, or establishing the validity of a hypothesis. Experiments are used to help understand why and how for example stock markets function the way they do.

Experiments can vary in both goal and scale, but they always rely on repeatable procedure and logical analysis of the results. The data that are collected in experiments can be used to estimate and test the validity of economic theories, and provide insight into causal effects by finding the outcomes that occur when a particular factor is manipulated. I will now comment on some strengths and weaknesses of experimental economics.

3.2 Comments on strengths and weaknesses

The main strength of experimental economics as I see it is the possibility to replicate or make close to similar experiments. If someone thinks that a student pool of 79 students in my experiment could be too small to generalize the results, they could run an experiment with more students and/or “real people”, like financial advisors. The more often an experiment is repeated, with similar results obtained, the more confident we can be that the theory that is tested is valid. If the design is criticised they can argue against it, make well-argued changes and see if it influences the findings.

George Loewenstein (1999) has described some problems regarding experimental economics. Experimental method is often seen as strong on validity, but Loewenstein questioned whether this method is sufficient to both internal and external validity. Internal validity is the ability to infer causal relationships from the specific research, whereas external validity is the ability to generalize the research context into settings that the research is intended to mimic. Loewenstein focuses on external validity in his commentary, where he suggests that experimental economics are particularly vulnerable.

Experimental economics can also be limited by problems with experimental incentive structures. In the real-world people face complex incentives, and thus identifying meaningful incentive structures can be difficult. For example subjects initially motivated by intellectual curiosity and a desire to be helpful, can be distracted and demotivated by small experimental payments. This issue has been discussed by Gneezy and Rustichini (Gneezy & Rustichini, 2000a, 2000b). When it comes to my experiment I can`t see this influencing one group more than another though.

The “House-money-effect” could also influence experimental economics. This effect was presented by Thaler and Johnson (Thaler & Johnson, 1990) and shows that people tend to take more risk if he or she has earned money easily or unexpectedly: *The premise that people are more willing to take risks with money they obtained easily or unexpectedly.*

In my experiment the participants got 100 experimental units, equalling 16 NOK (2,75 USD), in each of the 12 rounds. Since participants got the chance of investing the money in a lottery (”gamble”) a house-money-effect could occur since participants could tend to take more risks. This because of no risk of losing money they previously had (no participation fee) and feeling that “everything is a bonus”. Thaler and Johnson (1990) also found that people are less willing to take risks after a loss compared to after a win. I think that the house-money-effect might influence the amount of risk aversion each individual shows in the experiment, but it is not likely to influence one group more than the other.

Harrison and List (2004) point out the fact that using students as subjects in experiments have been commonly criticized and that “real people” may be preferable. The design that I used in my experiment has been used on “real people” (financial traders etc.) earlier and shown similar main results. Therefore I don’t see this criticism as an argument against the validity of my potential main findings, and in any case this is a common critisism to any lab experiment using student subjects. If my budget wasn’t limited however, I would have considered having both a larger student pool and a control group of “real people”.

Another concern often raised is that students might be self-selected in some way. I therefore asked the participants to fill out a questionnaire after the experiment. In this way I could control for some of these factors in the analysis. In my case, a recruitment bias might exist since people that neither are on Facebook nor check their student email would not have received information about the date and time of the experiment sessions, unless a friend or associate told them. Because of restrictions on the student-email account regarding sending emails, I was only able to send around 1200 emails a day. Thus only students with a first name starting with letters A-K got an email before the participants list was fully booked, but again this is not likely to affect one group more than the other.

3.3 Earlier practice and conducting of experiments

In this part I will look on previous experiments that are related to my experiment. The focus will be on relevant previous experiments regarding risk-taking on behalf of oneself, on behalf of others and gender differences. The reader will also get some background information on how experiments have been designed and executed previously.

3.3.1 Students

Gneezy and Potters (1997) designed their lottery after Benartzi and Thaler (1995) proposed myopic loss aversion as a possible solution to the equity premium puzzle. They conducted 14 experiment sessions, seven in each of the two treatment groups. Their experiments were conducted using pen and paper and the participants were students from the Tilburg University. The participants were told that the experiment would last around 40 minutes and that they would get a reward depending on the choices they made, but normally between 5 and 35 Dutch guilders. The choice they were given was to invest between 0 and up to 100 in a lottery. In each round the chance for winning in the lottery was 1/3, and the risk of losing was 2/3. The students that won received 2,5 times the amount invested, while the amount that was not invested was earned for certain. On average, investing in the lottery yielded a return of 16,67%.

Gneezy and Potters divided into two different treatments and the experiments had nine rounds. In each treatment half of the students received high frequency feedback, meaning they received feedback from the outcome of the lottery after each round, while the other group only received feedback every third round.

The idea behind the two treatments was to manipulate the evaluation period. In treatment LF (low frequency of feedback) the frequency of choice and information feedback was lower than in treatment HF (high frequency of feedback). Therefore the subjects in LF were expected to evaluate the consequences of betting in a more aggregated way, i.e. that if subjects were characterized by MLA, the low frequency group would be more opt to bet money in the lotteries. In fact, this was exactly what happened, as the low frequency group on average invested 66,7 percent in the lottery compared to the high frequency group's average of 50,1 percent.

3.3.2 Professional traders and financial advisors

Haigh and List (2005) conducted a similar experiment as Gneezy and Potters (1997). The difference though was that they invited professional traders as well as students to participate in the experiment. Their main finding was that professional traders exhibited myopic loss aversion (MLA) to an even greater extent than students. Professional traders invested as much as nearly 75 units in the low frequency treatments and as low as 45 units in the high frequency treatment. The gap between student choices in the different treatments was much lower, 62,5 versus 50,89, which was quite similar to the results from Gneezy and Potters (1997) .

Eriksen and Kvaløy (2010b) made use of all SR-Bank's, a medium sized Norwegian bank, financial advisors to conduct a similar experiment as Haigh and List. Their paper was a robustness check of Haigh and List's rather surprising findings that financial advisors exhibit MLA to a greater extent than students. The advisors invested 68,6 and 47,8 in the lottery while students invested 59,1 versus 49,2, thus the financial advisors exhibited MLA to a greater extent than students, and this is consistent with Haigh and List's findings.

3.3.3 Other people's money

As Eriksen and Kvaløy (2010a) pointed out, literature was scant on the basic question of how people behave when taking risks on behalf of others, given the large experimental literature on risk-taking. They therefore wanted to investigate this issue further. The standard rational model namely has a clear prediction that there should be no MLA-effect when investing other people`s money. They used the same design as GP to investigate whether MLA was shown when investing money on behalf of others.

On the contrary to the standard rational model Eriksen and Kvaløy (2010a), found that "investment managers" reacted to manipulation of frequency in the same way as people did when investing their own money, thus exhibiting behaviour consistent with myopic loss aversion. Interestingly they also found that groups of subjects, especially men, took less risks with other people's money than with their own. They found this by comparing the group that made choices on behalf of themselves, "own", against the group that made choices on behalf of “others”. The groups “own” and “others” did not consist of the same individuals and were conducted on separate occasions.

Chakravarty, Harrison, Haruvy, and Rutström (2011) used a first price sealed bid auction, as well as a lottery choice task known as multiple price list (MPL) in their experiment, to test for differences between “own” and “others”. In the MPL task the subjects were faced with the task of choosing lottery A or lottery B on each row in a table. At some point in the table subjects are expected to switch between the alternatives, thus this can be used to infer their risk attitudes. In the sealed bid auction the participants acted as both “agent” and “self”, thus the exact same individuals made choices both for themselves and for others in the same experiment. This is contrary to previous experiments as experimenters previously only compared groups that acted on behalf of themselves with the results to a group that acted on behalf of others, thus the individual participant didn`t participate in both conditions (“own” as well as “others”).

Chakavatry et al. (2011) thus found an opposite conclusion to Eriksen and Kvaløy (2010a) with the remarkable result that individuals tend to be significantly less risk averse when they make decisions about another person`s money, compared to decisions made with their own money.

3.3.4 Gender differences

One of the most common stereotypes is that women are more risk-averse than men. Charness and Gneezy (2007) assembled data from 10 sets of experiments and found very consistent result that women invest less, and thus appear to be more financially risk averse than men. They do though underline some problems with the empirical investigation of individual differences in risk-taking, namely the variation in the methods used to study the phenomenon, making it difficult to compare results across experiments. They also argue that some papers found gender differences without looking for them and that others were specifically designed to examine for gender differences.

Barber and Odean (2001) wanted to test two predictions, after psychologists, in areas such as finance found that men are more overconfident than women. The two predictions were; men will trade more than women and the performance of men will be hurt more by excessive trading than the performance of women. They tested these hypotheses by analysing 35,000 household accounts at a large discount brokerage firm. Accounts opened by men nearly had turnover rates of common stocks 1,5 times the accounts opened by women. Men's net returns were also on average 0,94 percentage points lower than for women. The difference is even larger when they compared single men vs single women. Single men on average traded 67% more than women and thereby reduced their returns by 1,44 percentage points.

Eriksen and Kvaløy (2010a), using the GP-design, found that men on average invested 52,8 and 50,7 in the different treatments, whereas women invested less, 40,8 and 40,3 respectively.

3.3.5 Teams and adolescents

Matthias Sutter (2005) found that team decisions are also characterized by myopic loss aversion, and that teams also invest significantly more than individuals do. This had according to Sutter three main implications. First, it supported the validity and applicability of the theoretical concept of MLA for a wider range of decision-makers, namely teams as well as individuals. Second, the results show that MLA is a valid explanation for the equity premium puzzle, irrespective of which type of decision-maker that is present on financial markets. Third, the result has practical relevance for organizations since important financial decisions often are taken by teams rather than individuals.

Another study by Matthias Sutter and colleagues was whether MLA was present during adolescence (Glätze-Rützler, Sutter, & Zeileis, 2013). Surprisingly, their findings suggested no evidence of MLA in a sample of 755 individuals between ages of 11 to 18. MLA was neither present when they made individual decisions nor when they made team-decisions. However men as expected invested more than women. In my opinion these results does not discredit MLA as a possible explanation for the equity premium puzzle since the financial markets are dominated by investors over the age of 18.

4.0 Experiment design and procedure

4.1 The Gneezy and Potters experimental design

Since the design of my experiment is very similar to Gneezy and Potters well-known design (1997), I will first describe their design and then present the changes I introduce.

The objective of their experiment was to test for myopic loss aversion (MLA). In order to test this, the groups were given different feedback frequency. The high frequency groups received feedback each round and the low frequency groups received feedback only every third round. All participants would make choices for themselves in 9 rounds. In each round the chances of winning in the lottery were 1/3, and the risk of losing is 2/3. If they won the subjects would receive 2,5 times the amount invested, i.e. if they invested 100 and won, they would get paid 350 in that round. The amount that was not invested would be returned for certain without any chance of losing or winning. Thus, if they invested 0 in the lottery they would receive 100 with a probability of 1. On average, investing in the lottery yields a return of 16,67%. The experiment by Gneezy and Potters was conducted using pen and paper.

There are connections between the lottery design to the real world. In the real world the possibility to get feedback or evaluate your portfolio only each third period or year is available, since you can decide for yourself how often you wish to check your portfolio. In the real world there is also options regarding how much you want to invest in risky and safe investments, just as in the lottery design. You can invest everything in stocks, everything in bonds, or a combination since rebalancing funds exist. Rebalancing funds have a fixed sum of both stocks and bonds, for example SKAGEN Balanse 60/40, where 60% is invested in stocks and 40% in bonds and rebalanced on a daily basis (Skagenfondene, 2013).

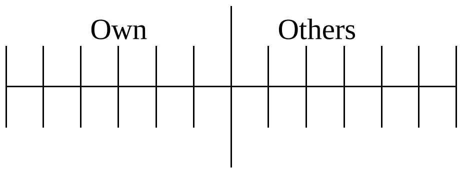
4.2 The changes to the original design

The lottery is the same as in GP’s design (1997). Each round the participants in my experiment will receive 100 EK (experimental units), which equals 16 NOK (Norwegian kroner).

The first design change is that the participants would make choices on how much to invest for 12 rounds instead of the original nine[1]. This is caused by the next important design change. Instead of making decisions only on behalf of themselves, participants were also going to make decisions on behalf of others. In six rounds the participants were going to make choices on behalf of themselves ("own") and could affect their own payment. In the six other rounds they were going to make choices on behalf of another person in the room ("others"). In the rounds deciding for another the choices would only affect the payment of the other person. The other person in the room would in the same six rounds make choices that affected the other person's payment. The participants didn't know which person in the room they were making choices on behalf of. The reason behind this design change was that I wanted the participants to make as many choices for themselves and for others in the same experiment, using a within-design. This "twist" has as far as I am aware of never been executed and tested before.

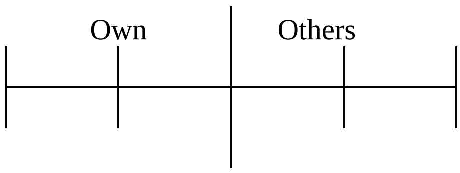
To test for MLA, half of the participants received feedback each round (high frequency) and the rest received feedback only each third round (low frequency). In each frequency group, half of the participants would start with deciding for themselves and the other half will start deciding for others. The reason for this is to limit the influence learning effect that during the rounds could have an effect on the final result. In previous research participants have shown a tendency to reduce the amount of investment in the later rounds and I did not want this to potentially influence only "own" or only "others". The different treatment groups and within-design are then as follows:

HF1



*The amount of feedback (short downward lines), condition change (longer downward line)

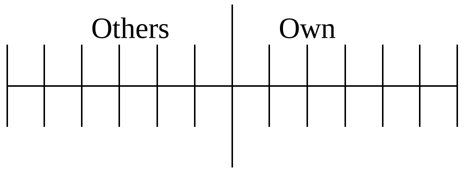
LF1



*The amount of feedback (short downward lines), condition change (longer downward line)

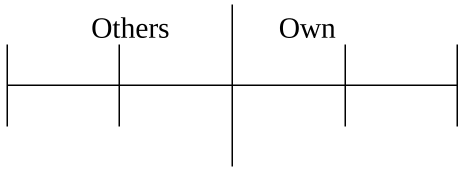
[1] To use 9 rounds in deciding for oneself and for others would mean 18 rounds in total and the real money potential pay-off would have had to be reduced because of budget constraints. In addition it would be more time-consuming for participants than previous similar experiment sessions, where 9 or 12 rounds in total are most common.

HF2



*The amount of feedback (short downward lines), condition change (longer downward line)

LF2



*The amount of feedback (short downward lines), condition change (longer downward line)

After the first 6 rounds there will be a short questionnaire to make it clearer that the first game has ended and the next game is about to begin (see pages 48 and 50-53 in the appendix). After the last 6 rounds there will be a longer questionnaire with relevant background questions. In each game the participants will get questions indicating specifically in which of the “own” or ”others”-treatment they are in. In high frequency the question on the screen will be as follows when deciding for oneself (translated to English): “How much do you want to invest in the lottery for yourself in round X”. When deciding for others the question will be: “How much do you want to invest in the lottery for another person in round X.”

There was also change in the information given about the lottery. Instead of the original 100+2,5X as an additional explanation of the lottery in a parenthesis, the following text was given: If you invest 100 you will 1 out of 3 times receive 350 and 2 out of 3 times receive nothing. Instead of 100-X as additional information about the amount that is not invested in the lottery, the following example was given: If you invest 0 in the lottery you will receive 100 for certain. The idea behind this change was to make the lottery even easier to understand. None of the 79 participants asked any questions about the instructions.

My experiment was also computerized using z-Tree (Fischbacher, 2007), and not on pen and paper like Gneezy and Potters (1997) did[2].

[2] One of the reasons behind this change was to limit the amount of sessions needed to complete the results for all the four groups. When using the lab each group only needed one session for completion, thus for example reducing the potential “word of mouth effect” that could have influenced students participating in later sessions. It is also likely that it was less time-consuming for the participants as well as being a more commonly known process for students in Stavanger, because of prior experiments with z-Tree, for example by Eriksen and Kvaløy at the university.

4.3 Hypotheses

Because of prior experiments lack of consensus decision-making on behalf of others *(see Chapter 4: Relevant research, experiments and experimental literature)* I wanted to construct an experiment that could investigate the issue further, as well as testing the robustness of prior findings that men take more risk than women. In addition, I also wanted to investigate whether people with high frequency of feedback would take less risk than people with less frequent feedback. I therefore ended up with the following three hypotheses:

1. The high frequency feedback groups will invest significantly less in the lottery compared to the groups with low feedback frequency
2. Decision-making on behalf of others compared to decision-making on behalf of oneself will not differ from decision-making on behalf of others, when it comes to the amount of investment in the lottery
3. Men will invest significantly more than women in the lottery

4.4 The reasons behind choosing this design and procedure

The design has been used several times before and the results I get will be comparable with previous research. The changes I have made in the experiment-design, namely deciding for oneself and others in the same experiment using a within-design adds a new dimension. It will be interesting to see whether the results are similar to prior research, and it will especially intriguing to see what effects, if any, the design change has on the results. This new element has as far as I am aware of never been done with the GP-design before.

Another reason I find this change interesting is that investing not only on behalf of oneself but also on behalf of others on more or less the same occasion is quite common, yet very little research has been done on this. When it comes to fund saving agreements, couples can either have separate accounts or one account together. Often however there is only one person that makes decisions for both. One acquaintance of mine who decides which funds to invest in on a monthly basis in two separate accounts (one for himself and one for his girlfriend) had this to say about their monthly investments: "In my account I have mostly got stocks but I don't think my girlfriend wants to take that much risk so in her account I invest more in bonds."

Fund managers often invest their own money in the same fund they manage thus they are often indirectly investing for themselves as well as for others.

The reason for choosing students is mainly that it was the only way I could get up to 20 people in each group without “breaking the budget”. Students are both cheaper payment wise, as well as being easier to contact and organize regarding conducting experiments.

4.5 Participants and the day of the experiment

All together 79 undergraduate students from the University of Stavanger, participated in the experiment. They were recruited on their student email-account and from student-organization groups on Facebook. They were told that they had the opportunity to participate in an economic experiment where they could earn a decent sum of money.

There were a total of 39 students in the low frequency (LF) groups and 40 in the high frequency (HF) groups:

- Low frequency 1 (own, others), 19
- Low frequency 2 (others, own), 20
- High frequency 1 (own, others), 20
- High frequency 2 (others, own), 20

The reason that the low frequency 1 group wasn’t complete was that a student who didn`t understand Norwegian turned up, and participants had already started reading the instructions when she informed me of this. I therefore felt that finding a replacement in such a short space of time could influence the other ones (noisier circumstances during the reading of instructions) as well as the potential new subject 20 would also have got less time to read the instructions than the others. Since there was no subject 20 to influence the payment of subject 19 in the “others part” of the experiment, subject 19 got paid the average of what the other 18 subjects earned when choosing for “others”.

Sessions were held at 10:00, 11:00, 13:00 and 14:00 on April 9th. “Boxes” where set up on the computers in advance to avoid insight from one participant to another. The LF sessions took around 15 minutes and the HF sessions around 20 minutes (see appendix page 45 for picture). After each session the participants received anonymous payment. In total 16,815 NOK were paid out to the participants, an average of 212,85 NOK each. (see appendix page 54 for all separate payments in each session).

5.0 Results

5.1 The Main Picture

Table 1. The amount of investment in each of the four main groups

	Own	Others
High Frequency (HF)	65	63,2
Low Frequency (LF)	77,3	63,7

When combining the results from the four different groups, the participants that received high frequency feedback (HF) invested on average 65 when making choices for themselves and 63,2 when investing for others, whereas the participants with low frequency invested as much as 77,3 when deciding for themselves and 63,7 when making choices for others.

In HF there were a total of 18 men and 22 women, and in LF 17 men and 22 women, thus when it comes to gender the groups were pretty evenly split. When it comes to previous experiment participation there were 27 in the LF treatment and 23 in HF treatment, thus a pretty even split there as well, and therefore not likely to influence one group more than another. None of the background questions influenced results except for previous participation. To see the background questions that were asked and the GLS-regression random effect result see appendix page 49 and 55.

In general investment levels are higher in my experiment compared to previous similar experiments. Investment levels in Gneezy and Potters (1997) were 66,7 in LF and 50,1 in HF while in my treatments combined, as you can see in table 2, was higher. A possible explanation for higher investment amounts is that many participants have previously participated in similar experiments. As can be seen in the regression in the appendix, the group of people that had participated in similar experiments invested, on average, around 18 more than people that hadn't participated before. The change in investment design could also have had an effect.

To test for significant differences between groups I used the Mann Whitney U-test at 95% level which has been commonly used when analysing results from experiments with the GP-design. The Mann-Whitney U is a non-parametric statistic test whether the null hypothesis that two populations are the same hold against an alternative hypothesis. If the test goes in favour of the alternative hypotheses, a particular population may have larger values than the other. One limitation to this test is that the data points should be independent of one another. Since I have used results in blocks (three rounds equals one data point) like Gneezy & Potters (1997), all participants have influenced four data points in the analysis (12 rounds divided by 3) and those are not necessarily independent of one another (how you choose the first three rounds is likely to influence how you choose in the last three rounds etc.).

Except when comparing own results in HF against investment on behalf of others in HF, I have used “blocks” (each participant = 4 observations, like Gneezy and Potters) when comparing differences in investment levels between participants. When comparing own investments in HF against investments on behalf of others in HF, I compared 12 observations of each participant, but added “blocks” results in the parenthesis.

To control for other factors, like previous participation, I have in addition run an ordinary least squares (OLS) and a generalized least squares (GLS) random effects panel data test. Ordinary least squares (OLS) are a method in statistics for estimating the parameters of a multiple linear regression model. The OLS estimates are obtained by minimizing the sum of squared residuals between the observed responses in the dataset and the responses that are predicted by the linear approximation. Generalized least squares (GLS) are a method in statistics for estimating the unknown parameters in a linear regression model. The GLS can be used when variances of the observations are unsimilar, i.e. there is heteroscedasticity, and/or when there is a certain degree of correlation between observations. If one or both of these are present, OLS can be statistically inefficient.

5.2 High- and low frequency feedback

The first hypotheses is directly related to myopic loss aversion and is that high frequency feedback groups will invest significantly less in the lottery compared to the groups with low feedback frequency.

From table 2 you can see that participants invested significantly less in the HF treatment compared to the LF treatment, when you combine decisions on behalf of oneself as well as in the new element others. In table 2 the investment in LF is close to constant in all rounds while the investments fall in the last three rounds in HF. Thus, by comparing raw investment averages, the total combined investments points towards MLA. However, the regressions in table 5 and 6, do not confirm a statistical difference (between HF- and LF combined) when controlling for gender and previous participation.

Table 2 The combined results LF (own and others) vs HF (own and others)

	HF combined		LF combined			
	Mean	St.d	Mean	St.d	Mann Whitney	Significance
First 3*	66,7	33,7	70,2	31,9	-1,33	No
Last 3*	61,5	38,5	70,8	35,2	-2,6	Yes
Total	64,1	36,3	70,5	33,5	-2,75	Yes

*First three means the first three rounds in each game (own and others), while last three means last three rounds in each game (own and others). This is the same in all "combined" tables. Significance level is 5%, which means that a result of 1,96 and above and -1,96 and below is significant. This is the same in all tables.

One interesting thing to notice if we move to table 4 is that, if we separate ”own" from ”others", the picture changes. As previously people that invest with their own money suffer from MLA and there is statistical difference between the HF and the LF group in "own". However there is no statistical difference between HF and LF when it comes to investing on behalf of others, as you can see in table 4. Thus, results in "others" suggest that participants are not influenced by the frequency of feedback when it comes to the amount they invest for other people. This is in contrast to MLA findings in Eriksen and Kvaløy (2010a), when investing on behalf of others. The participants invested on behalf of both themselves and others in the same experiment due to the design-change, and since the results differ from previous studies, this should encourage further research on investing for "others".

In three out of the four main groups, see table 3, people invest less in the last three rounds compared to the first three rounds. It is only when they invest for themselves in low frequency (LF own) that the investment is higher, whereas participants seem to take less risks towards the end in the three other groups. The overall picture therefore points towards MLA.

Table 3: Investments from the four main groups

	HF Own		HF Others		LF Own		LF Others	
	Mean	St.d	Mean	St.d	Mean	St.d	Mean	St.d
First 3*	67,1	34,3	66,3	33,2	75	28,4	65,4	34,4
Last 3*	62,8	40	60,2	37,1	79,6	30	61,9	37,8
Total	65	37,3	63,2	35,3	77,3	29,3	63,7	36,1

*First three means the first three rounds in the game, while last three means last three rounds in the game. This is the same in all tables, except the "combined" tables.

Table 4: The connection between LF own and others vs HF own and others

	Means		St.ds		Mann Whitney U	Significance
LF own vs HF own	77,3	65	29,3	37,3	-3,26	Yes
LF others vs HF others	63,7	63,2	36,1	35,3	-0,48	No
LF total vs HF total	64,1	36,3	70,5	33,5	-2,75	Yes

Table 5: Regression 1 OLS, The significance of gender differences when controlling for previous participation and frequency, and the significance of frequency when controlling for gender and previous participation (frequency and gender could influence each other).

Source	SS	df	MS	Number. Obs: 316 F (3, 312) = 10.53	
Model	29282,6	3	9760,5	Prob > F = 0,0	
Residual	289212,7	312	927	R-squared = 0,0919	
Total	318495,3	315	1011,1	Adj. R-squared = 0,0832	
				Root MSE = 30.446	
Invest	Coeffsient	Std. Error	t	P>|t|	95% conf-interval	
Highfrequency	-4,8	3,44	-1,39	0,164	-11,57	1,97
Female	-6,69	3,45	-1,94	0,054	-13,49	0,1066
Previous Participation	17,06	3,55	4,81	0	10,07	24,03
Constant	62,89	3,99	15,77	0	55,04	70,74

*The dependent variable is the invested amount (constant). The independent variables takes into account which treatment the participants were in (LF or HF), gender (female or male), and controls for differences caused by previous participation.

Table 6: Regression 2 GLS, The significance of gender differences when controlling for previous participation and frequency, and the significance of frequency when controlling for gender and previous participation (frequency and gender could influence each other).

		R-squared					
Number of observations	316	Within	0	Prob > chi2 = 0,0	0,0022	sigma_u 18,68	
Number of groups	79	Between	0,1672	Wald chi2(3)	19,91	sigma_e 24,16	
Obs. Per group	4	Overall	0,0919			rho=0,374	
Invest	Coeffsient	Std. Error	z	P>|z|	95% conf-interval		
Highfrequency	-4,85	5	-0,97	0,333	-14,66	4,97	
Female	-6,72	5,02	-1,34	0,181	-16,56	3,13	
Previous Participation	16,62	5,1	3,26	0,001	6,62	26,62	
Constant	62,89	5,77	10,95	0	51,88	74,51	

*The dependent variable is the invested amount (constant). The independent variables takes into account which treatment the participants were in (LF or HF), gender (female or male), and controls for differences caused by previous participation.

5.3 Investing for oneself and for others

The second hypotheses is that there will not be a significant difference between the groups on decision-making on behalf of others compared to decision-making on behalf of oneself when it comes to the amount of investment in the lottery.

If we include investments from both frequency groups when comparing investments in the own- and others condition as shown in table 7, the hypothesis is rejected since there is a significant difference between the mean investments of the two groups. This is especially strong for the difference in amounts invested in the last three rounds of the lottery. Participants invest the same in the first and last three rounds in the "own" treatment, whereas they invest less in the last three rounds compared to the first three when making choices on behalf of others. The regressions, in table 9 and 10, also confirm statistical difference in investments (between own and others combined) when controlling for participation in similar experiments.

Table 7: The connection between own combined (both LF and HF) and others combined (both LF and HF)

	Own Combined		Others Combined		Mann-Whitney U	
	Mean	St.d	Mean	St.d	+/-1,96	Significance
First 3	71	37,7	65,9	37,4	-1,39	No
Last 3	71,1	36,4	61	36,1	-3,22	Yes
Total	71,05	34,1	63,44	35,7	-3,33	Yes

If we look on LF and HF separately however, i.e LF own vs LF others, and HF own vs HF others (see table 8), there is only significant difference in one group, which is LF. Thus, it seems like the difference in investment for oneself and on behalf of others gets neutralized the more often one can evaluate investments and the more frequently one receives feedback. The investments in LF between own and others are statistically different, and in LF the participants take higher risk for themselves than they do on behalf of others. Even though the investment amounts are higher in HF own compared to HF others, the investments are not statistically different, however the tendency is similar. Going back to hypothesis 2, participants seem to take more risks when making choices for themselves compared to others, but this effect looks to be neutralized the more often they receive feedback. The HF-group ("own" vs "others") made choices according to the hypothesis, whereas the LF-group ("own" vs "others") did not.

Thus, it is only in the results in the LF-treatment that are consistent with prior research of Eriksen and Kvaløy (2010a), suggesting higher investments for oneself than on behalf of others. However, as previously stated, they compared the choices of two separate groups of participants acting either for "own" or "others" and not both in the same experiment, like in my within-design.

Table 8: The connection between LF own vs LF others, and HF own vs HF others

	Means		St.ds		Mann Whitney U	Significance
LF own vs LF others	77,3	63,7	29,3	36,1	-3,86	Yes
HF own vs HF others	65	63,2	37,3	35,3	-0,8* (-0,34)	No

*-0,8 is the 12 vs 12 results (all participants=12 observations). Result in parenthesis is the "blocks" result (one participants= 4 observations)

An interesting sidenote: Eriksen and Kvaløy (2010a) found that particularly men invested less on behalf of others compared to women, but my results point in the opposite direction since men invested 74,1 on behalf of themselves and 68,9 on behalf of others, a difference of negative 5,2, while women invested 68,6 on behalf of themselves and 59,1 on behalf of others, a difference of negative 9,5. See table page 47 in appendix.

Table 9: Regression 3 OLS, The significance of others controlling for previous participation

Source	SS	df	MS	Number. Obs: 316 F (2, 313) = 39,18
Model	28796,4	2	14398,2	Prob > F = 0,0
Residual	289697,9	313	925,6	R-squared = 0,0904
Total	318494,3	315	1011,1	Adj. R-squared = 0,0846
				Root MSE = 30,42

Invest	Coeffsient	Std.Error	t	P>ltl	95% conf-interval	
Others	-7,71	3,42	-2,25	0,025	-14,44	-0,97
Previous Participation	18,02	3,52	5,12	0	11,09	24,95
Constant	60	3,25	18,49	0	53,6	66,4

*The dependent variable is the invested amount (constant). The independent variables takes into account which condition the participants were in (own/others) and controls for differences caused by previous participation.

Table 10: Regression 4 GLS, The significance of others controlling for previous participation

		R-squared				
Number of observations	316	Within	0,0311	Prob > chi2 = 0,0	0	sigma_u 18,45
Number of groups	79	Between	0,1381	Wald chi2(3)	19,91	sigma_e 24,50
Obs. Per group	4	Overall	0,09047			rho=0,362

Invest	Coeffsient	Std. Error	z	P>|z|	95% conf-interval	
Others	-7,71	2,71	-2,84	0,005	-13,03	-2,39
Previous Participation	17,66	5,08	3,48	0,001	7,7	27,62
Constant	60,21	4,22	14,26	0	51,94	68,49

*The dependent variable is the invested amount (constant). The independent variables takes into account which condition the participants were in (own/others) and controls for differences caused by previous participation.

5.4 Men and women's investments

The third hypothesis is that men will invest significantly more than women in the lottery. As you can see from table 11 and table 12, this looks to be true in both LF, HF and both frequencies combined (HF+LF). Thus, prior research (Charness & Gneezy, 2007) seems to be robust, as this experiment is in line with these findings. The regressions in table 5 and 6 however do not confirm a statistical difference on a 95% level (between men and women) when controlling for condition (own and others) and previous participation. The OLS-regression is however very close to being statistically different on a 95% level. The regressions do indicate though that other factors than gender are more important for the investments levels. When you look on investments levels between men and women without controlling for other factors, there is no doubt that there is statistical difference.

Table 11: The combined results men (own and others) vs women (own and others)

	Men Combined		Women Combined		Mann Whitney U	Significance
	Mean	St.d	Mean	St.d		
First 3	72	35,3	65,6	30,5	-1,26	Yes
Last 3	71	38	62,1	36,1	-2,28	Yes
Total	71,5	36,6	63,9	33,4	-2,6	Yes

Table 12: The connection between HF men vs HF women, and LF men vs LF women

	Means		St.ds		Mann Whitney U	Significance
HF men vs HF women	69	60,1	36	36	-3,37* (-1,72)	Yes
LF men vs LF women	74,1	67,7	37,2	30,2	-2,12	Yes

*Since all participants made 12 choices in highfrequency I find it most relevant to compare 12 vs 12 when comparing results in HF againts each other. With the HF vs HF exception, I have used blocks (4 vs 4) like Gneezy and Potters (1997). Results in "blocks" are in paranthesis.

6.0 Conclusion

When acting on behalf of themselves participants seem to exhibit MLA, but there were no significant differences when investing for others. The result in others is especially interesting, considering my experiment design change, and that previous experimenters didn’t test both conditions (“own” and “others”) with exactly the same participants. When it comes to the equity premium puzzle and MLA as a possible explanation, the results from my experiment are also interesting, as you can easily claim that the stock markets have investors that invest on behalf of others. It is, however, difficult to draw an explicit line in which of the findings of “own” or “others” that is most relevant for the real world. This is because you often find yourself in a situation which you invest on behalf of others as well as for yourself (fund managers etc.), alternatively think of others while investing for oneself (partner etc.). The combined investments of own money and on behalf of others (see table 2), could therefore be closer to the real world. Results from the experiment suggest that the average investments of investors having low frequency of decisions are higher than investors having high frequency of investment decisions. This in turn suggests there is MLA present in investor’s investment decisions.

An experiment with a fixed share of payments between paired participants might get a closer approximation to the real world, than the combined results of investments with own- and others money. However, “the weighting of thinking” of oneself or others, when it comes to investing, is likely to be different from one person to another and thus difficult to examine. As there is statistical difference in investments in LF on behalf of others but not in the HF treatment, it seems like the difference in investment for “own” and “others” gets neutralized the more often you can evaluate investments and the more frequently you receive feedback. Men invested statistically more than women in both HF and LF with a Mann-Whitney U, but not when controlling for other factors with OLS and GLS-panel data tests. To conclude explicitly one way or the other on these two hypotheses thus seems difficult.

Depending on how you weight the results, MLA may or may not be a plausible solution to the equity premium puzzle. If I focus on results in “own”, as most previous research, the answer would be yes. The combined results (“own” and “others” summarized), also point towards MLA as a possible solution to the EPP. However, results show no MLA findings in investments on behalf of others, suggesting that participants are not influenced by the frequency of feedback when investing for others.

7.0 Final reflections

I hope that my Master's thesis will encourage other experimenters to use the same concept, only testing it directly on financial advisors, as results between students and financial advisors in previous studies have shown to be significantly different. A robustness check of the results on students could also be appropriate since a group of 20 is sensitive to outliers and thus has the potential to be too small in order to be robust. Another version of my experiment design could also be to have different feedback frequency in the same groups when you make choices on behalf of themselves compared to others and vice versa.

Another one could be to have the same experiment over 12 rounds where paired participants investments are equally shared 50-50, and check if the participants exhibit MLA. Results from an experiment with that design might be even closer to the real world since most investments in the financial markets are made not only on behalf of oneself but also on behalf of others, either because they are customers or since it could affect the whole household economy of the investor. However, since the enjoyable journey of writing my thesis and conducting an experiment is now over, I will like to leave these reflections open for other experimenters to investigate.

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Appendix

Some pictures from the day of the experiment:

LF, HF and total results:

LF total	**Round 1-3**			**Round 4-6**			**Round 7-9**			**Round 10-12**			**Round 1-12**		
	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.
All	67,4	32,2	117	72,5	32,7	117	73,1	31,4	117	69	37,6	117	**70,5**	33,5	468
Men	70,3	35,3	51	74,1	35,8	51	76,8	38,3	51	75,3	40	51	**74,1**	37,2	204
Women	65,1	29,7	66	71,3	30,2	66	70,2	24,8	66	64,1	35,2	66	**67,7**	30,2	264
Own	74,7	26,1	57	83,7	27,2	57	75,2	30,7	60	75,8	32,2	60	**77,3**	29,3	234
Others	60,4	35,9	60	62	34,1	60	70,8	32,3	57	61,8	41,6	57	**63,7**	36,1	234
Men own	74,2	29,8	18	91,7	19,2	18	82,3	30,9	33	80	34,4	33	**81,8**	30,3	102
Men oth.	68,2	38,2	33	64,5	39,3	33	66,7	48,5	18	66,7	48,5	18	**66,5**	41,8	102
Women own	75	34,7	39	80	29,7	39	66,6	28,6	27	70,7	29,2	27	**73,9**	28,1	132
Women oth.	50,8	30,8	27	58,8	26,8	27	72,7	21,8	39	59,6	38,5	39	**61,5**	31	132

HF total	**Round 1-3**			**Round 4-6**			**Round 7-9**			**Round 10-12**			**Round 1-12**		
	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.
All	63,9	34,4	120	58,4	39	120	69,4	32,9	120	64,7	38	120	**64,1**	36,3	480
Men	64,3	36	54	62,2	39,8	54	76,7	30,8	54	72,9	35,9	54	**69**	36	216
Women	63,6	33,2	66	55,2	38,4	66	63,5	33,6	66	57,9	38,5	66	**60,1**	36	264
Own	73,5	35,4	60	62,1	43,2	60	60,7	32,2	60	63,6	36,9	60	**65**	37,3	240
Others	54,4	30,7	60	54,7	34,3	60	78,2	31,5	60	65,7	39,2	60	**63,2**	35,3	240
Men own	64,1	42,1	27	59,6	43,9	27	70,2	33,5	27	73,8	36,6	27	**66,9**	39,1	108
Men oth.	64,5	29,4	27	64,7	36	27	83,1	26,9	27	72	36	27	**71,1**	32,8	108
Women own	81,2	36,8	33	64,1	45,8	33	52,9	32,5	33	55,2	35,4	33	**63,4**	35,9	132
Women oth.	46,1	29,6	33	46,4	31	33	74,2	34,8	33	60,6	41,6	33	**56,8**	36,1	132

All total	**Round 1-3**			**Round 4-6**			**Round 7-9**			**Round 10-12**			**Round 1-12**		
	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	**Mean**	St.d	Obs.
All	65,6	33,3	237	65,4	36,7	237	71,2	32,2	237	66,8	37,8	237	**67,3**	35,1	948
Men	67,2	35,6	105	68	38,2	105	76,7	34,5	105	74,1	37,8	105	**71,5**	36,6	420
Women	64,4	31,4	132	63,3	35,4	132	66,8	29,6	132	61	36,9	132	**63,9**	33,4	528
Own	74,1	31,1	117	72,6	37,8	117	67,9	32,1	120	69,7	35	120	**71,1**	34,1	474
Others	57,4	33,4	120	58,3	34,2	120	74,6	32	117	63,8	40,3	117	**63,4**	35,7	474
Men own	68,1	37,6	45	72,4	39,1	45	76,8	32,4	60	77,2	35,2	60	**74,1**	35,7	210
Men oth.	66,5	34,3	60	64,6	37,5	60	76,6	37,4	45	69,9	41	45	**68,9**	37,4	210
Women own	77,8	25,8	72	72,7	37,2	72	59	29,5	60	62,2	33,5	60	**68,6**	32,5	264
Women oth.	48,2	30	60	52	29,6	60	73,4	28,3	72	60,1	39,7	72	**59,1**	33,7	264

The four individual group results:

LF1	Round 1-3			Round 4-6			Round 7-9			Round 10-12			Round 1-12		
	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.
All	74,7	26,1	57	83,7	27,2	57	70,8	32,3	57	61,8	41,6	57	**72,75**	31,8	228
Men	74,2	29,8	18	91,7	19,2	18	66,7	48,5	18	66,7	48,5	18	74,825	36,5	72
Women	75	34,7	39	80	29,7	39	72,7	21,8	39	59,6	38,5	39	71,825	31,175	156

LF2	Round 1-3			Round 4-6			Round 7-9			Round 10-12			Round 1-12		
	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.
All	60,4	35,9	60	62	34,1	60	75,2	30,7	60	75,8	32,2	60	**68,35**	33,225	240
Men	68,2	38,2	33	64,5	39,3	33	82,3	30,9	33	80	34,4	33	73,75	35,7	132
Women	50,8	30,8	27	58,8	26,8	27	66,6	28,6	27	70,7	29,2	27	61,725	28,85	108

HF1	Round 1-3			Round 4-6			Round 7-9			Round 10-12			Round 1-12		
	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.
All	73,5	35,4	60	62,1	43,2	60	78,2	31,5	60	65,7	39,2	60	**69,875**	37,325	240
Men	64,1	42,1	27	59,6	43,9	27	83,1	26,9	27	72	36	27	69,7	37,225	108
Women	81,2	36,8	33	64,06	45,8	33	74,2	34,8	33	60,6	41,6	33	70,015	39,75	132

HF2	Round 1-3			Round 4-6			Round 7-9			Round 10-12			Round 1-12		
	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.	Mean	St.d	Obs.
All	54,4	30,7	60	54,7	34,3	60	60,7	32,2	60	63,6	36,9	60	**58,35**	33,525	240
Men	64,5	29,4	27	64,7	36	27	70,2	33,5	27	73,8	36,6	27	68,3	33,875	108
Women	46,1	29,6	33	46,4	31	33	52,9	32,5	33	55,2	35,4	33	50,14	32,125	132

Questionnaires (translated from Norwegian):

Questionnaire after game 1

- Write PC-number (see the receipt-sheet)
- Would you like to participate in other experiments? (yes or no)

Following message after questions: Then game 2 will soon start

Questionnaire after game 2

- Age
- Gender
- Branch of study/Faculty
- Write short how you were thinking when investing in the lottery
- Closest average grade
- Have you participated in an experiment before?
- Do you invest in stocks or stock funds?
- How well is your knowledge about stocks and stock funds? (over average, average, under average)
- Have you taken the course Behavioural Finance?
- How many study-years have you had at the UiS?
- Marital status?
- Have you taken the course Personal Finance?
- In what game did you invest the most in the lottery?

Following message after questions: Thank you for participating! Fill in everything on the receipt-sheet except the amount. Bring the receipt-sheet and wait outside the room. You will shortly be called in one by one and get paid as soon as we have summarized the payment from both games.

Receipt sheet (translated from Norwegian)

Receipt sheet:

PC-number: ....

I confirm to have participated in an experiment on ...09.04.13.....

And received an amount of ....

Name/Signature...

Experiment instructions:

Instructions to the experiment (translated from Norwegian, group LF1)

1. The experiment consists of 2 games with 6 rounds. After game 1 there will be a short questionnaire, while it after game 2 will be a longer questionnaire.
2. You shall make investment choices on behalf of yourself the first six rounds (game 1), while you in the last six rounds (game 2) shall make decisions on behalf of another.
3. You will start with 100 experimental units (EK) in every round.

How do the investment choices work?

- You shall for <u>three rounds at a time</u> decide how much you want to invest in a lottery (from 0 to 100)
- With 1/3 chance the lottery will give you 2,5 times the investment in return, and with 2/3 chance you will lose the investment. (Example: If you invest 100 then 1 out of 3 times you will receive 350 and 2 out of 3 times you will get 0 in return)
- The amount you choose not to invest will be yours for certain (Example: If you bet 0 in the lottery you get 100 in the round for certain)
- You as participant will randomly be divided into type 1, 2 or 3, and every round one of the three types will randomly be drawn as a winner
- 100 EK is equal to 16 Norwegian kroner (NOK) every round.

Game 1

In this game you shall make investment choices on behalf of yourself. Here you will influence your payment. After round 3 you will get the results from round 1 to 3. Thereafter you must decide how much you want to invest in the lottery in round 4 to 6.

Game 2

In this game you will make investment choices on behalf of another person in the same way as game 1. The choices you make will influence another participant's payment. One randomly chosen participant will do the same for you.

Payment

The amount of Norwegian kroner (NOK) you have after the first 6 rounds will be paid out after both game 1 and game 2 are finished. In game 2 another participant will have made choices that affect your payment in game 2.

Practical information

Follow the instructions on the screen, enter (0 to 100) and press the OK-button along the way. Take into account that there might be some waiting during the experiment. You shall not talk and/or have contact with other participants. If you have got any questions, raise your hand and we will answer. After the experiment is over, you write your name on the receipt sheet, then you go and wait outside the room. You will then shortly be called in one by one.

Instructions to the experiment (translated from Norwegian, group LF2)

1. The experiment consists of 2 games with 6 rounds. After game 1 there will be a short questionnaire, while it after game 2 will be a longer questionnaire.
2. You shall make investment choices on behalf of another the first six rounds (game 1), while you in the last six rounds (game 2) shall make decisions on behalf of yourself.
3. You will start with 100 experimental units (EK) in every round.

How do the investment choices work?

- You shall for three rounds at a time decide how much you want to invest in a lottery (from 0 to 100)
- With 1/3 chance the lottery will give you 2,5 times the investment in return, and with 2/3 chance you will lose the investment. (Example: If you invest 100 then 1 out of 3 times you will receive 350 and 2 out of 3 times you will get 0 in return)
- The amount you choose not to invest will be yours for certain (Example: If you bet 0 in the lottery you get 100 in the round for certain)
- You as participant will randomly be divided into type 1, 2 or 3, and every round one of the three types will randomly be drawn as a winner
- 100 EK is equal to 16 Norwegian kroner (NOK) every round.

Game 1

In this game you shall make investment choices on behalf of another. The choices you make will influence another participant's payment. One randomly chosen participant will do the same for you. After round 3 you will get the results from round 1 to 3. Thereafter you must decide how much you want to invest in the lottery in round 4 to 6.

Game 2

In this game you will make investment choices on behalf of yourself in the same way as game 1.

Payment

The amount of Norwegian kroner (NOK) you have after the last 6 rounds will be paid out after both game 1 and game 2 are finished. In game 1 another participant will have made choices that affect your payment in game 1.

Practical information

Follow the instructions on the screen, enter (0 to 100) and press the OK-button along the way. Take into account that there might be some waiting during the experiment. You shall not talk and/or have contact with other participants. If you have got any questions, raise your hand and we will answer. After the experiment is over, you write your name on the receipt sheet, then you go and wait outside the room. You will then shortly be called in one by one.

Instructions to the experiment (translated from Norwegian, group HF1)

1. The experiment consists of 2 games with 6 rounds. After game 1 there will be a short questionnaire, while it after game 2 will be a longer questionnaire.
2. You shall make investment choices on behalf of yourself the first six rounds (game 1), while you in the last six rounds (game 2) shall make decisions on behalf of another.
3. You will start with 100 experimental money (EK) in every round.

How do the investment choices work?

- You shall for <u>each round</u> decide how much you want to invest in a lottery (from 0 to 100)
- With 1/3 chance the lottery will give you 2,5 times the investment in return, and with 2/3 chance you will lose the investment. (Example: If you invest 100 then 1 out of 3 times you will receive 350 and 2 out of 3 times you will get 0 in return)
- The amount you choose not to invest will be yours for certain (Example: If you bet 0 in the lottery you get 100 in the round for certain)
- You as participant will randomly be divided into type 1, 2 or 3, and every round one of the three types will randomly be drawn as a winner
- 100 EK is equal to 16 Norwegian kroner (NOK) every round.

Game 1

In this game you shall make investment choices on behalf of yourself. After round 1 you will get the result from this. Thereafter you must decide how much you want to invest in the lottery in round 2 before you get the result. The procedure will be the same from round 3 to 6.

Game 2

In this game you will make investment choices on behalf of another in the same way as game 1. The choices you make will influence another participant's payment. One randomly chosen participant will do the same for you.

Payment

The amount of Norwegian kroner (NOK) you have after the first 6 rounds will be paid out after both game 1 and game 2 are finished. In game 2 another participant will have made choices that affect your payment in game 2.

Practical information

Follow the instructions on the screen, enter (0 to 100) and press the OK-button along the way. Take into account that there might be some waiting during the experiment. You shall not talk and/or have contact with other participants. If you have got any questions, raise your hand and we will answer. After the experiment is over, you write your name on the receipt sheet, then you go and wait outside the room. You will then shortly be called in one by one.

Instructions to the experiment (translated from Norwegian, group HF2)

1. The experiment consists of 2 games with 6 rounds. After game 1 there will be a short questionnaire, while it after game 2 will be a longer questionnaire.
2. You shall make investment choices on behalf of another the first six rounds (game 1), while you in the last six rounds (game 2) shall make decisions on behalf of yourself.
3. You will start with 100 experimental money (EK) in every round.

How do the investment choices work?

- You shall for <u>each round</u> decide how much you want to invest in a lottery (from 0 to 100)
- With 1/3 chance the lottery will give you 2,5 times the investment in return, and with 2/3 chance you will lose the investment. (Example: If you invest 100 then 1 out of 3 times you will receive 350 and 2 out of 3 times you will get 0 in return)
- The amount you choose not to invest will be yours for certain (Example: If you bet 0 in the lottery you get 100 in the round for certain)
- You as participant will randomly be divided into type 1, 2 or 3, and every round one of the three types will randomly be drawn as a winner
- 100 EK is equal to 16 Norwegian kroner (NOK) every round.

Game 1

In this game you shall make investment choices on behalf of another. The choices you make will influence another participant's payment. One randomly chosen participant will do the same for you. After round 1 you will get the result from this. Thereafter you must decide how much you want to invest in the lottery in round 2 before you get the result. The procedure will be the same from round 3 to 6.

Game 2

In this game you will make investment choices on behalf of yourself in the same way as game 1.

Payment

The amount of Norwegian kroner (NOK) you have after the last 6 rounds will be paid out after both game 1 and game 2 are finished. In game 1 another participant will have made choices that affect your payment in game 1.

Practical information

Follow the instructions on the screen, enter (0 to 100) and press the OK-button along the way. Take into account that there might be some waiting during the experiment. You shall not talk and/or have contact with other participants. If you have got any questions, raise your hand and we will answer. After the experiment is over, you write your name on the receipt sheet, then you go and wait outside the room. You will then shortly be called in one by one.

Payment-list:

Participant	PC-number	10:00	11:00	13:00	14:00
1	D51537	225	230	105	215
2	D51525	305	280	275	180
3	D51603	170	240	170	175
4	D51555	110	160	110	175
5	D51561	285	145	390	220
6	D51524	200	245	170	260
7	D51655	150	260	140	195
8	D51675	335	290	285	240
9	D51636	190	255	170	165
10	D51558	115	120	110	195
11	D51587	260	130	320	240
12	D51588	205	275	180	220
13	D51503	205	235	190	160
14	D51519	315	330	320	165
15	D51542	215	280	190	175
16	D51580	125	150	105	160
17	D51590	280	130	380	180
18	D51566	150	240	170	195
19	D51619	155	275	205	190
20	D51564		300	380	180
	Group total	3995	4570	4365	3885
				All total	**16815**
				Average	**212,85**

GLS regression with all background questions

		R-squared				
Number of observations	316	Within	0,0315	Prob > chi2	0,002	sigma_u17,65
Number of groups	79	Between	0,3062	Wald chi2(12)	37,33	sigma_e24,16
Obs. Per group	4	Overall	0,1839			rho=0,348

Invest	Coeffsient	Std. Error	z	P>|z|	95% conf.int	
Others	-7,68	2,72	-2,83	0,005	-13,01	-2,36
Highfrequency	-4,29	5,12	-0,84	0,402	-14,33	5,74
Female	-9,51	5,71	-1,66	0,096	-20,7	1,69
Previous Participation	18,46	5,14	3,59	0	8,38	28,54
Age	0,992	0,54	1,84	0,066	-0,0655	2,05
Education	3,41	2,11	1,62	0,106	-0,72	7,54
Invest (stocks/funds)	-3,02	6,45	-0,47	0,64	-15,66	9,62
Knowledge(stocks/funds)	7,04	3,86	1,83	0,068	-0,52	14,61
Grade	-4,79	4,2	-1,14	0,255	-13,03	3,45
Personal finance	0,12	7,66	0,02	0,987	-14,9	15,14
Behavioral Finance	19,64	16,12	1,22	0,223	-11,95	51,23
Marital status	-0,84	2,6	-0,32	0,747	-5,94	4,26
Constant	46,32	19,86	2,33	0,02	7,39	85,25